

# GRADUATE PROGRAM IN CELLULAR AND MOLECULAR BIOLOGY

## APPENDIX 2: SAMPLE COURSES

These are course suggestions based on previous years' offerings – discuss any course selections with your academic advisor for all options. Contact CMB to set up an advising meeting any time.

### Biochemistry (3 credits required)

- Level 1. BIOLCHEM 515-Introductory Biochemistry (FA/WI terms 3 cr)
- Level 2. BIOLCHEM/CHEMBIO 501/502-Chemical Biology I/II (FA/WI 3 cr/3 cr)
- Level 3. BIOLCHEM 528 Biology and Chemistry of enzymes 2 cr 1<sup>st</sup> half of WI semester  
BIOLCHEM 640-Post-transcriptional mechanisms (WI term 2 cr)  
BIOLCHEM 650-Mechanisms of Eukaryotic Gene Expression (WI term 3 cr)  
BIOLCHEM 660- Molecules of Life (FA term 2 cr)  
BIOLCHEM 673- Kinetics & Ligand Binding (WI term 2 cr)  
BIOLCHEM/CDB/M&I 675 - Advanced Topics in Protein Trafficking and Localization (WI term 2 cr every other yr)  
BIOLCHEM 690 Biochemical Regulatory Mechanisms (FA term 2cr)

### Cell Biology (3 credits required)

- Level 1. MCDB 428-Cell Biology (WI term 4 cr)
- Level 2. CDB 530-Cell Biology (FA term 3 cr)  
PHYSIOL 576/578-Signal Transduction/Membrane and Cellular Physiology (1/2 cr)
- Level 3. CDB 560 – Quantitative Fluorescence Microscopy (WI term 3 cr)  
CDB 581 – Developmental Genetics (FA term 3 cr)  
CDB 582 – Organogenesis: Stem Cells to Regenerative Biology (WI term 3 cr)  
MICROBIOL 640-642- Molecular and Cellular Immunology I/II/III (3 cr/1 cr/1 cr)  
CANC BIO 553-Molecular Biology of Cancer (2 cr)  
CDB 550-Histology (4 cr)  
BC/PHYS/PHRM 591 – Special Topics in Signal Transduction (2 cr)

### Genetics (3 credits required)

- Level 1. MCDB 427-Molecular Genetics (FA term 4 cr)
- Level 2. HUMGEN 541-Molecular Genetics (FA term 3 cr)  
CDB 581 – Developmental Genetics (FA term 3 cr)
- Level 3. BIOLCHEM 650-Mechanisms of Eukaryotic Gene Expression (WI term 3 cr)  
HUMGEN/PHYSIOL 555- Integrative Genomics (WI term 3 cr)  
HUMGEN 542-Genetic Basis for Disease (WI term 3 cr)  
HUMGEN 544 – Basic Concepts in Population and Statistical Genetics (3 cr)  
CDB 582 – Organogenesis: Stem cells to Regenerative Biology (WI term 3 cr)

### Grant Writing (Additional options; only Pharm 502 is required)

- PHYS/HG 555 – Integrative Genomics (WI)
- CDB 582 – Organogenesis: Stem Cells to Regenerative Biology (WI)
- BIOLCHEM 650 – Mechanisms of Eukaryotic Gene Expression (WI)
- BIOLCHEM 640 – Post-transcriptional mechanisms (WI)
- PIBS 502 – Introduction to Scientific Communication (WI)
- MCDB 615 – Topics in Cellular & Molecular Biology (WI)

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## APPENDIX 2: SAMPLE COURSES (continued)

### **Quantitative Training**

CMB students are required to take 2-3 credit hours of coursework that provides quantitative training. This requirement can be met by taking courses, either as electives or CMB core courses, from any one of the 4 areas below, or any other course approved by the CMB Director.

Coursework in statistics/biostatistics is highly recommended for any student without undergraduate statistics. Advanced training in statistics and/or statistical genetics is recommended for students whose research involves human and animal models or large scale datasets (genomic, proteomic, etc.).

### **Biostatistics/Statistics**

#### Biostatistics

- 501 – Introduction to Biostatistics (prereq: algebra) (4 cr) Fall
- 512 – Analyzing Longitudinal & Clustered Data Using Statistical Software (prereq 501, 521 or equiv) (3 cr) Winter
- 521 – Applied Biostatistics (Fundamental statistics, prereq: calculus) (4 cr) Fall
- 522 – Biostatistical Analysis for Health-Related Studies (prereq: 521 or 501 w/permission) (3 cr) Winter
- 601 – Probability and Distribution Theory (prereq: 3 terms of calculus) (4 cr) Fall
- 602 – Biostatistical Inference (Fundamental theory of inferential statistical procedures, prereq: 601) (4 cr) Winter
- 646 – High Throughput Molecular Genetic and Epigenetic Data Analysis (prereq: Stat 400, Biostat 521, 522 or permission) (3 cr) Winter

#### *Statistics*

- 400 – Applied Statistical Methods (4 cr)
- 401 – Applied Statistical Methods II (4 cr)
- 470 – Introduction to the Design of Experiments (4 cr)

### **Bioinformatics/Computer Science**

#### Computational Medicine and Bioinformatics

- BIOINF 524 – Foundations in BIOINF and Systems Biology (intro to statistics and bioinformatics tools on the web) (3 cr) Winter
- BIOINF 527 – Introduction to Bioinformatics and Computational Biology (for students with basic statistics and some programming knowledge who want to go deeper into bioinformatics) (4 cr) Fall
- BIOINF/PHYSIOL 520 – Computational Systems Biology in Physiology (3 cr)
- BIOINF 528 – Advanced Applications of Bioinformatics (3 cr) Fall
- BIOINF 545 – Data Analysis in Molecular Biology (3 cr)
- BIOINF 551 – Proteome Informatics (3 cr) Fall every other year
- BIOINF 575 – Programming Lab in Bioinformatics (introductory computer programming course for those interested in getting more involved in analysis) (3 cr)
- EECS 498 – Introductory Computer Programming (introductory computer programming course for those interested in getting more involved in analysis)
- Physiology 519 – Systems Biology (introduces relevant biochemistry and mathematical modeling before delving into systems biology applications)

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PHYSIOL/BIOINF 520 - Computational Systems Biology for Physiologists  
HUMGEN 551 – Computational Genomics (2cr) Winter

### **Quantitative Genetics**

HUMGEN 544 – Basic Concepts in Population and Statistical Genetics (3 cr) Fall  
BIOSTATS 666 – Statistical Models and Numerical Methods in Human Genetics (3 cr/Fall)

### **Biophysics/Quantitative Biochemistry and Cell Biology**

BIOLCHEM 528 – Biology and Chemistry of Enzymes (2 cr) Winter  
BIOLCHEM 530 – Structural Biology in Solution (3 cr) Fall  
BIOLCHEM 673 – Kinetics & Mechanism (2 cr) Winter  
BIOLPHYS 520 – Biophysical Chemistry I (3 cr)  
BIOLPHYS 521 – Biophysical Chemistry II (3 cr)  
BIOIPHYS 550 – Intro to Biophysics Laboratory (3 cr)  
BIOIPHYS 602 – Protein Crystallography (3 cr)  
BIOIPHYS 608 – Biophysical Principles in Microscopy (3 cr)  
CDB 560 – Quantitative Fluorescence Microscopy (3 cr) Winter

### **Alternative Courses (up to 3 credits)**

To facilitate the ability of students who did not follow the CMB curriculum at the outset to switch into CMB from other PIBS programs, in some cases the basic coursework may be fulfilled with an introductory survey class(es) from other PIBS programs that are typically used to fulfill elective credits. This is discussed on a case-by-case basis. Examples:

BIOINFO 525 or 527-Introduction to Bioinformatics  
BIOPHYS 520- Energetics, Interactions, and Dynamics of Biomacromolecules  
BIOSTAT 501-Introduction to Biostatistics  
MCDB 614-Experimental Models in Molecular, Cellular and Developmental Biology  
MICROBIOL 640-642-Molecular and Cellular Immunology  
NEUROSCI 601-Principles of Neuroscience  
PATH 581-Tissue, Cellular and Molecular Basics of Disease  
PHARMACOL 611-Principles of Pharmacology  
PHYSIOL 510- Systems & Integrative Physiology